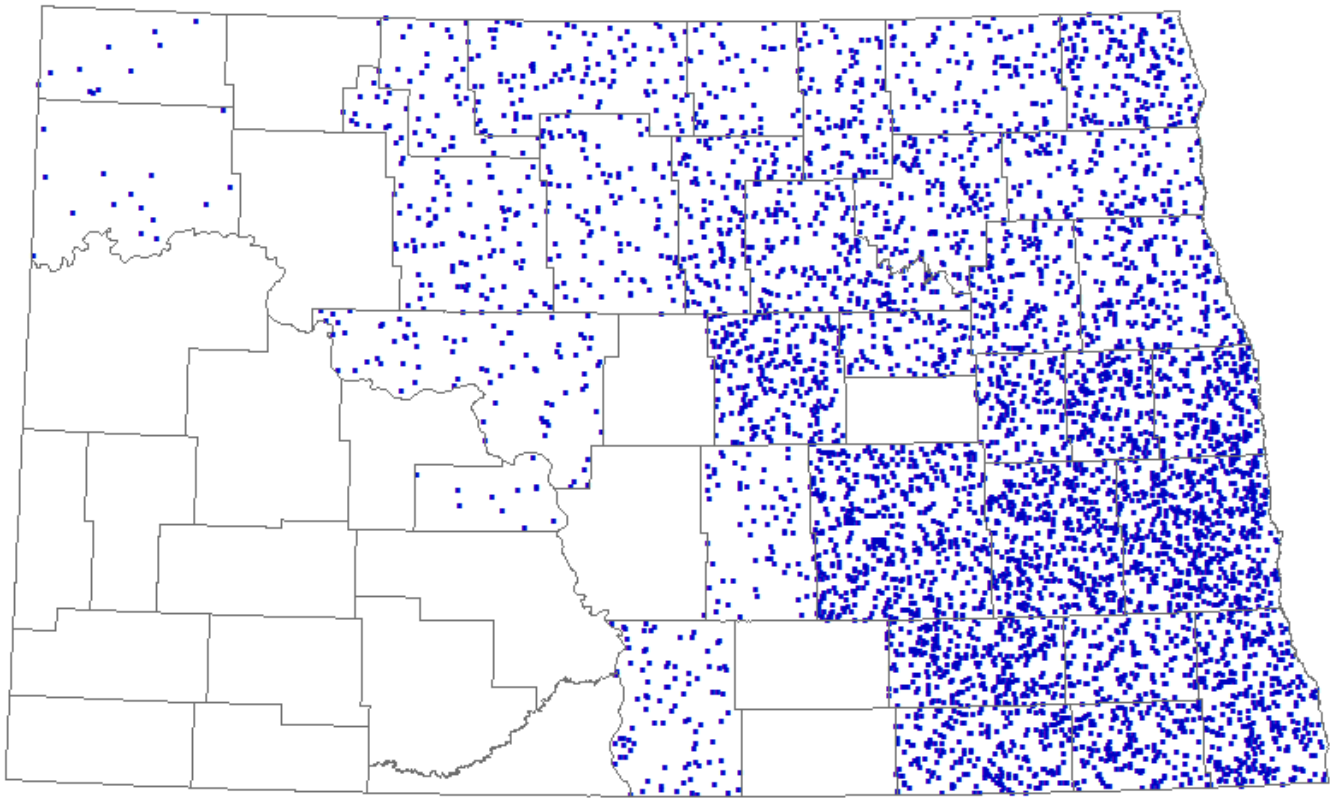
DISEASES AND INSECTS OF SOYBEAN IN NORTHERN GREAT PLAINS OF USA –

WHAT COULD BE IMPORTANT TO GROWERS IN SASKATCHEWAN?

Berlin Nelson Jr
Professor
Dept. Plant Pathology
North Dakota
State University

5.9 million A
2.4 million ha

Soybean Harvested Acres
North Dakota: 2014



1 Dot = 1,000 Acres

Dots randomly placed within county.
Blank counties represent none harvested or undisclosed data.

In 1980 there was 210,000 A or 85,000 ha

Diseases in North Dakota and northern Minnesota

Soybean Cyst Nematode- since 2003
Phytophthora root rot – important root rot in Valley
Seedling diseases: a complex of pathogens
Root rot complex- caused by various pathogens

Fusarium and Rhizoctonia root rots
White mold (Sclerotinia stem rot)

Charcoal rot; Stem canker; Brown stem rot
No rust in ND and no Sudden Death Syndrome

Insects: soybean aphid, spider mites

Two important soil related problems in North Dakota / northern MN

Salinity - soybeans do not tolerate EC values of >2 dS/m

Iron deficiency chlorosis

SEEDLING DISEASES

SEEDLING DISEASES

Variety of pathogens:

Pythium spp.

Phytophthora sojae

Fusarium spp.

Rhizoctonia solani

Rotting seeds

Damage from Pythium

Healthy seedling roots

SEED TREATMENTS FOR SOYBEAN

Improve stand and protect seedlings from pathogens- Especially under poor conditions for seed germination or when there is high pathogen population.

***Phytophthora* and *Pythium*: Mefenoxam or metalaxyl**
***Rhizoctonia*: Carboxin, fludioxonil, azoxystrobin**
***Fusarium* : azoxystrobin, fludioxonil**

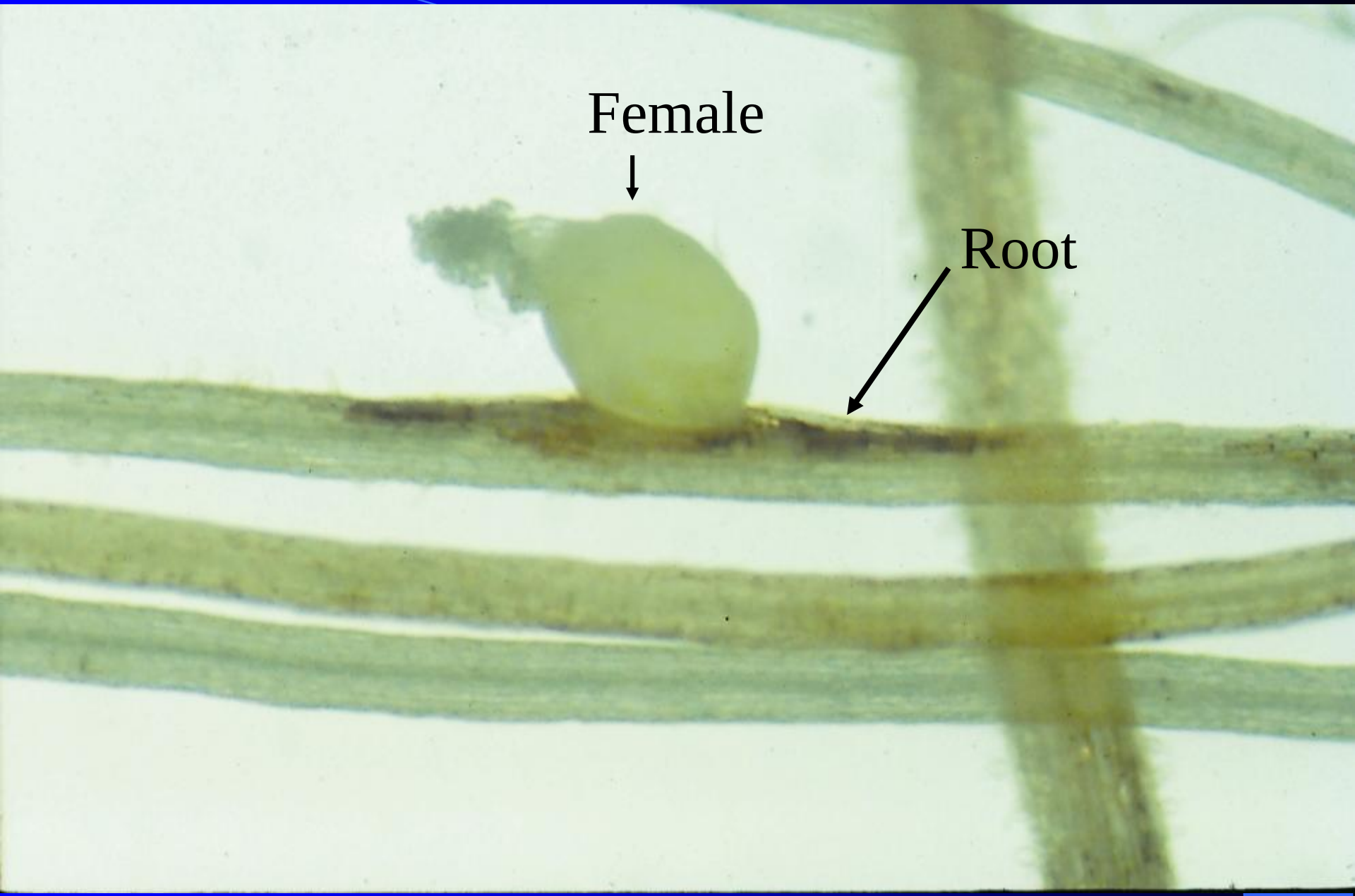
Rule of thumb: use a broad spectrum chemical

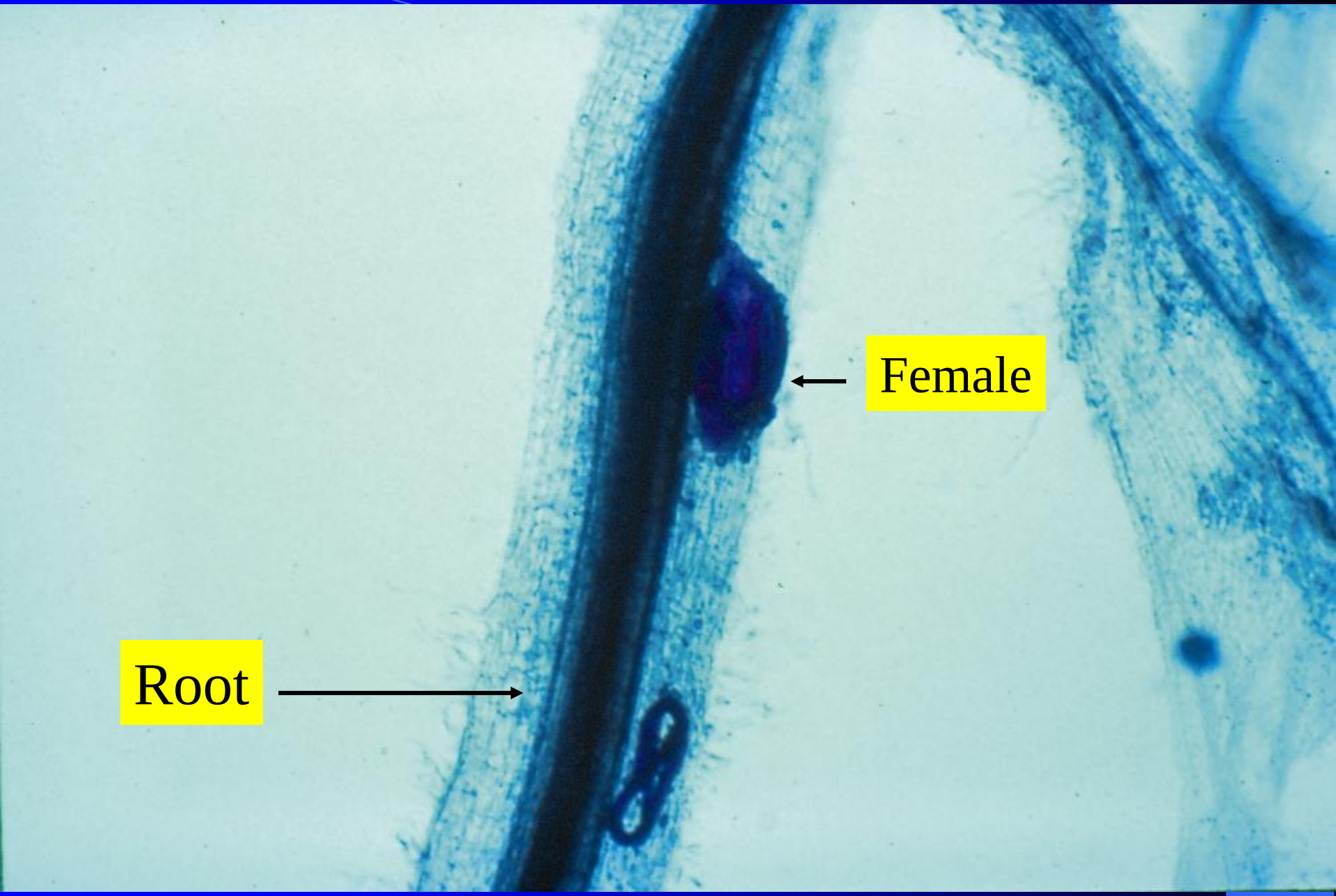
Soybean Cyst Nematode

Most important soybean pathogen in the U.S

- **1954 first report in USA**
- **Moving north- in Aug 03 found in SE ND.**
- **Very easy to spread from field to field**
- **High yield loss !**

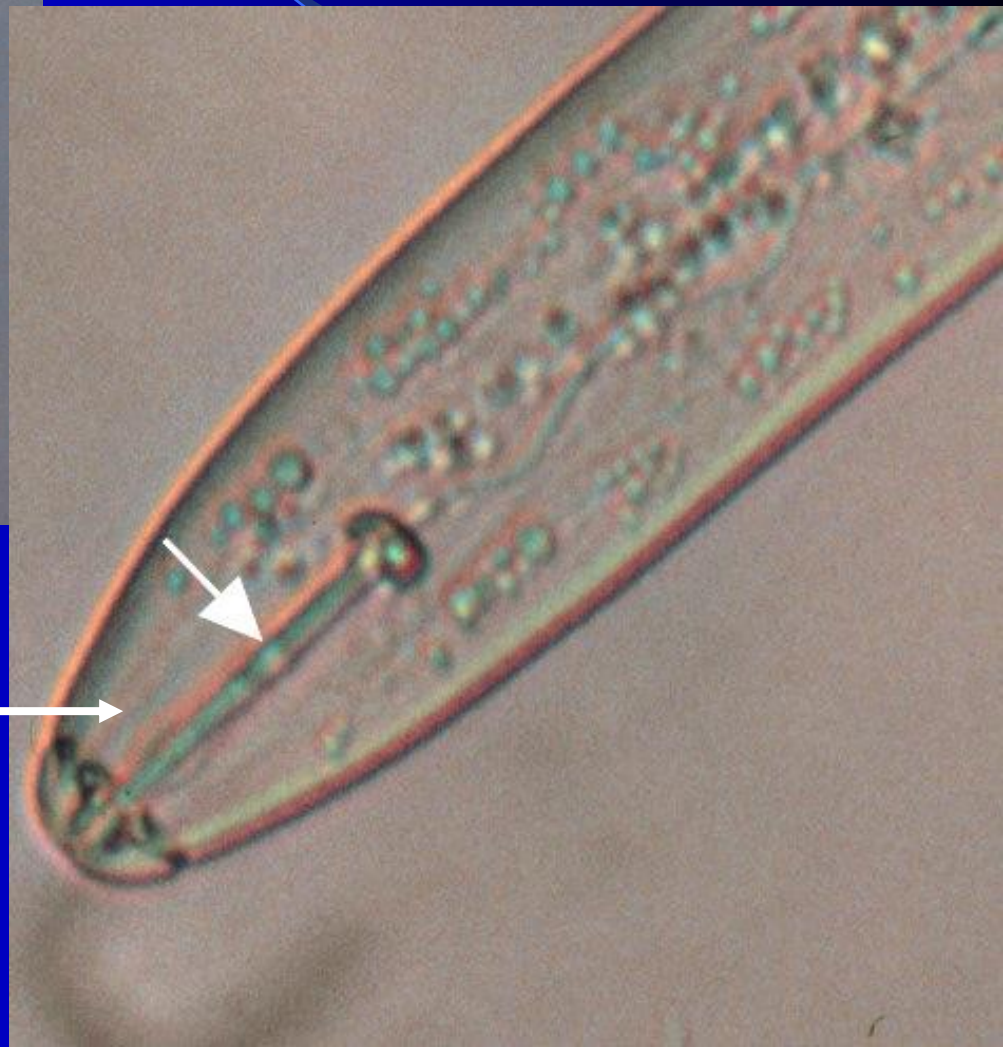
Female nematodes (arrow) on the roots of soybean


Female
Root


Female
Root

Adult females (white) and brown cysts of SCN

Second stage larvae infects root

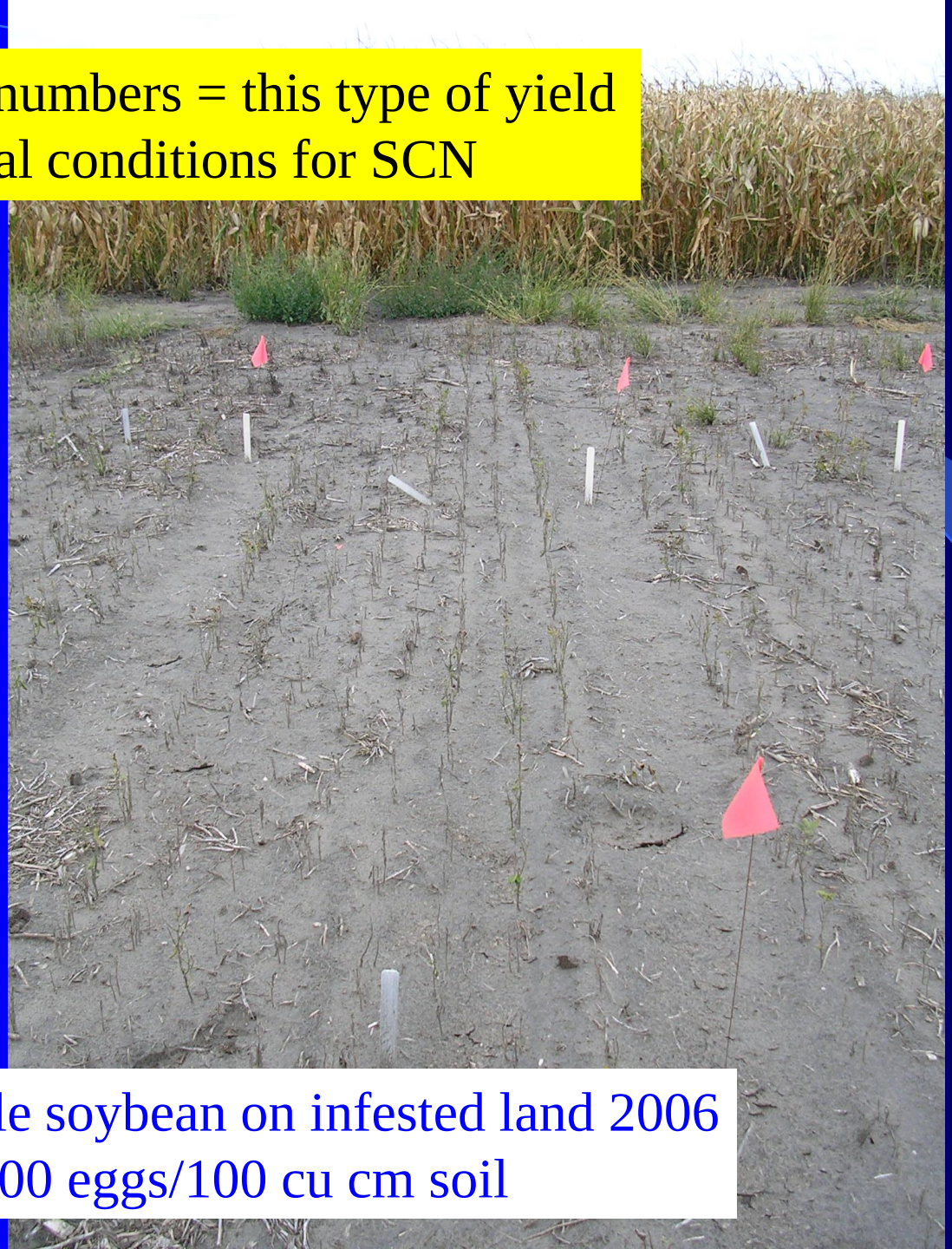


The stylet penetrates the host cell

SCN can be patchy in a field

Symptoms of SCN in the field. Often there are no above Ground symptoms!!!

High egg numbers = this type of yield
Under ideal conditions for SCN

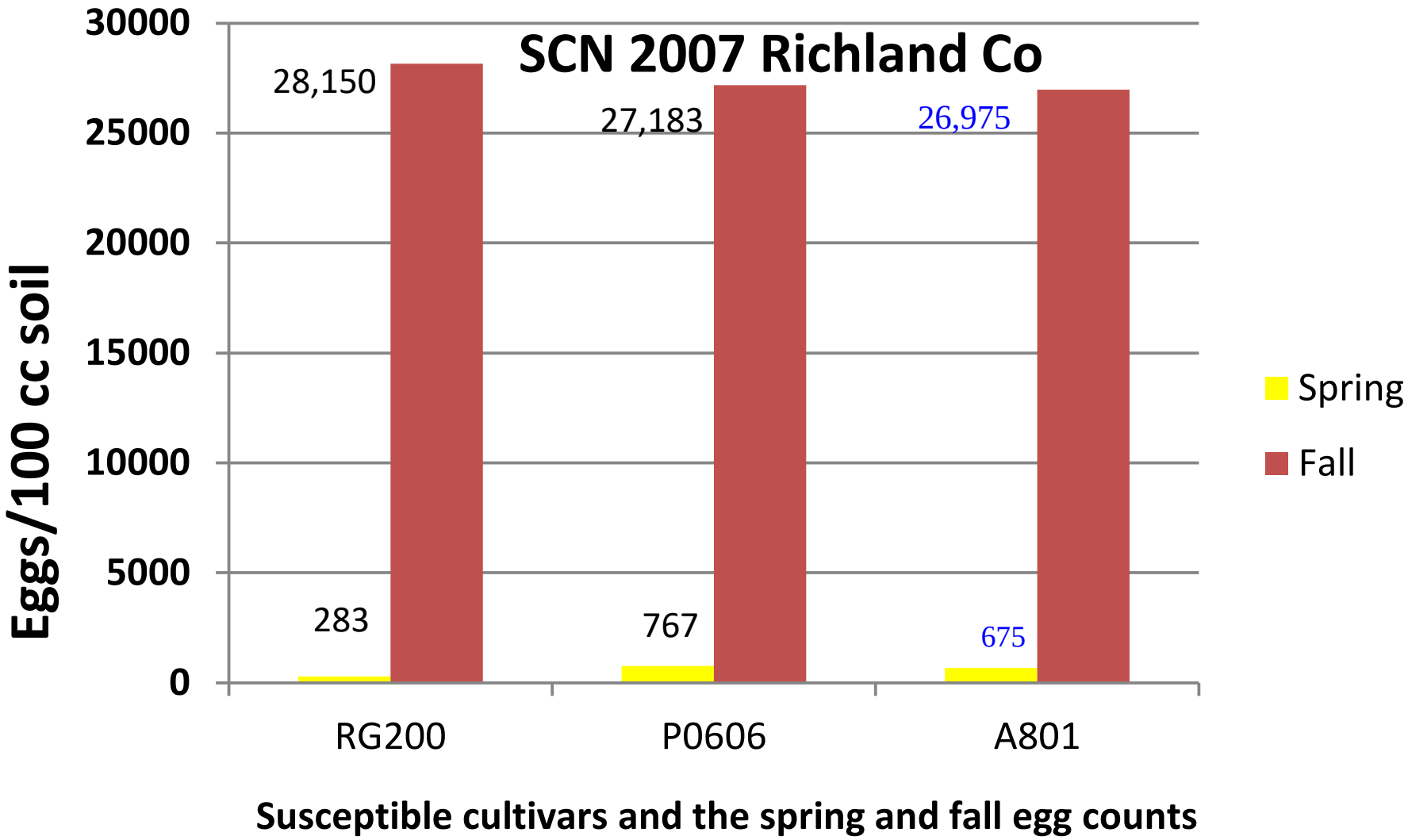


Susceptible soybean on infested land 2006
About 4,000 eggs/100 cu cm soil

A susceptible cultivar on SCN infested soil.
Notice no obvious above ground symptoms

Resistant cultivar on SCN infested soil. Notice dense canopy

What level of SCN reproduction do we find on susceptible cultivars in ND?



SCN MANAGEMENT = egg management

1. **Determine SCN population in soil.**
   Sample soil and send to lab to determine egg numbers/100 cubic cm soil

Egg threshholds: not used – do not plant a susceptible soybean

SCN MANAGEMENT = egg management

1. **Determine SCN population in soil.**
   Sample soil and send to lab to determine egg numbers/100cc soil

2. **Reduce SCN populations by**
   --Crop rotation to non hosts
   --SCN Resistant cultivars

In North Dakota only two important hosts: Soybean & drybean

Soybean cyst nematode

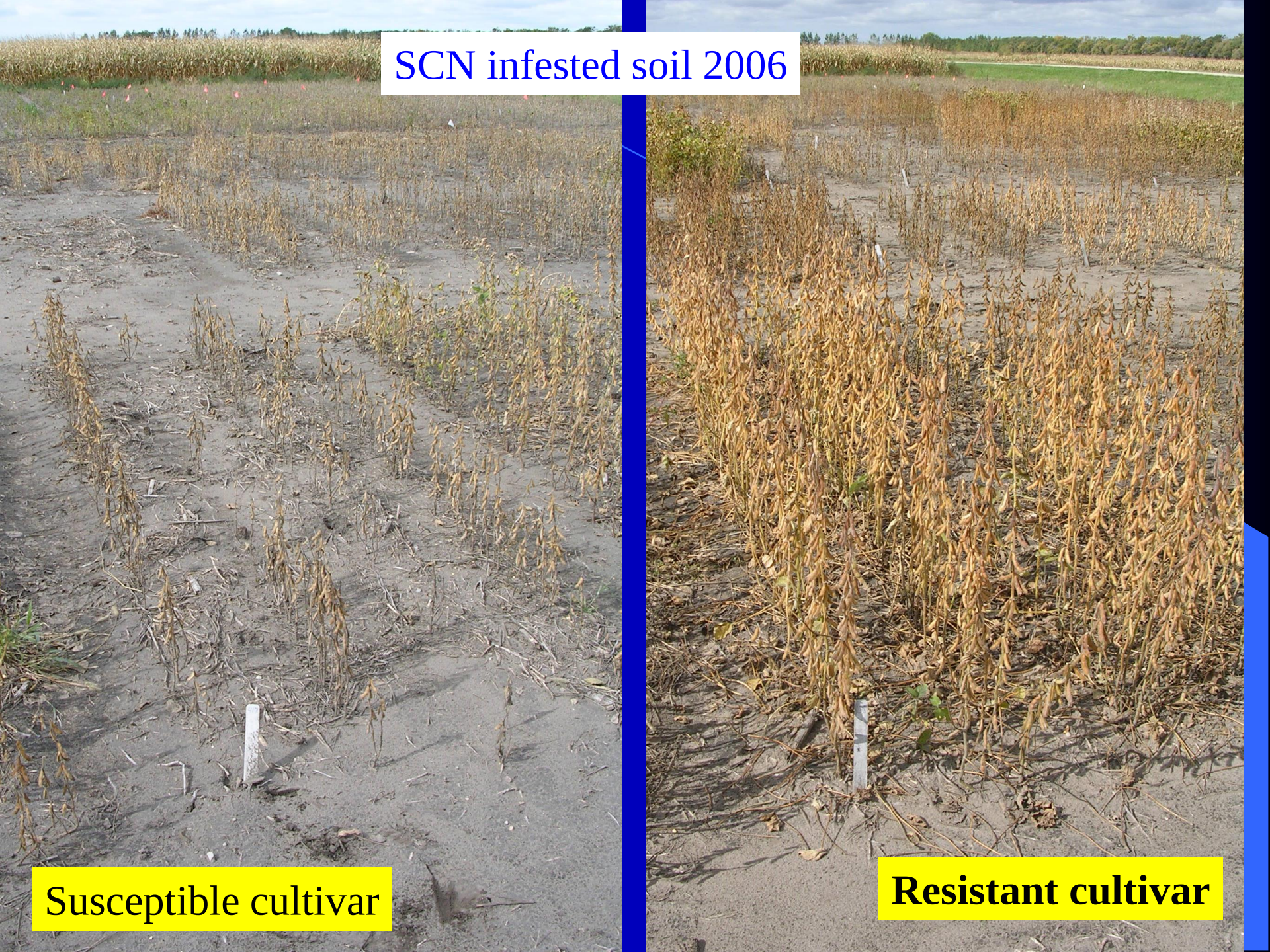
Small grains are non-hosts

Canola – non host
Flax – non host
Mustard – poor host
Sunflower- non host
Camelina – poor host

Lentil – non host
Field pea – poor host
Chickpea – poor host
Faba bean – poor host
Common bean – good host
Soybean – good host

Weed hosts – there are a number of weed hosts, but most are poor hosts.

Henbit and pennycress Are good hosts


SCN infested soil 2006
Susceptible cultivar
Resistant cultivar

Phytophthora root rot

P. sojae

Most important disease in Red River Valley

Soil borne;
Flooded conditions favor disease
Plants always susceptible
Most damage in seedling/young plant stages
Can destroy entire fields
Numerous races of the pathogen

Field with serious loss from Phytophthora root rot.

Wilting plants with brown cankers at base

Phytophthora root rot management

Use a resistant cultivar

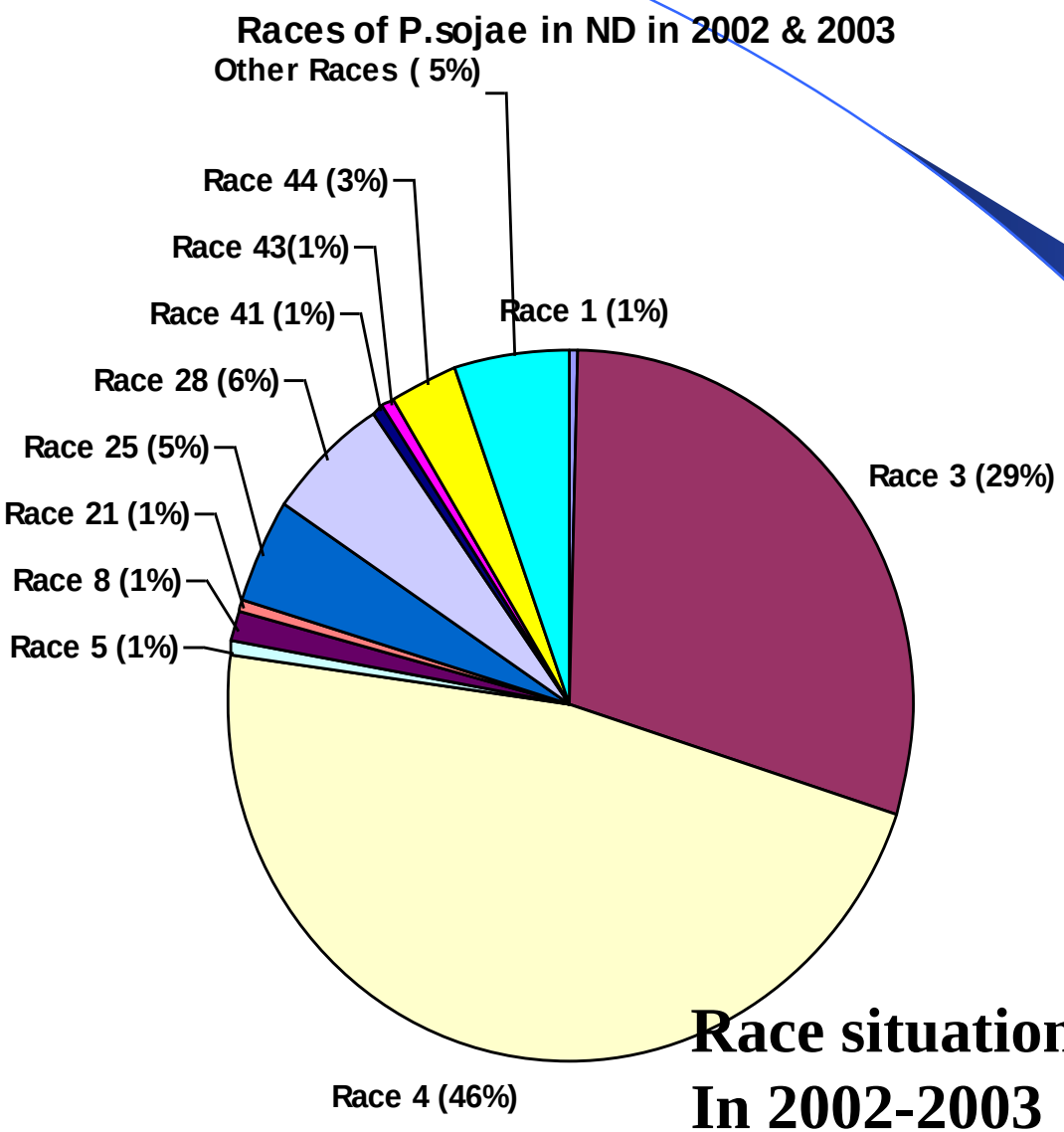
Some cultivars have field tolerance

Field drainage is important to reduce soil flooding

Chemical seed treatment can protect young seedlings, but not older plants

Crop rotation will not reduce pathogen populations

Numerous races of the pathogen



Race situation in North Dakota In 2002-2003

Fusarium root rot caused by the fungus *Fusarium solani* and other *Fusarium species*

Soilborne pathogen; causes cortical root rot;
Can cause damping-off at high populations

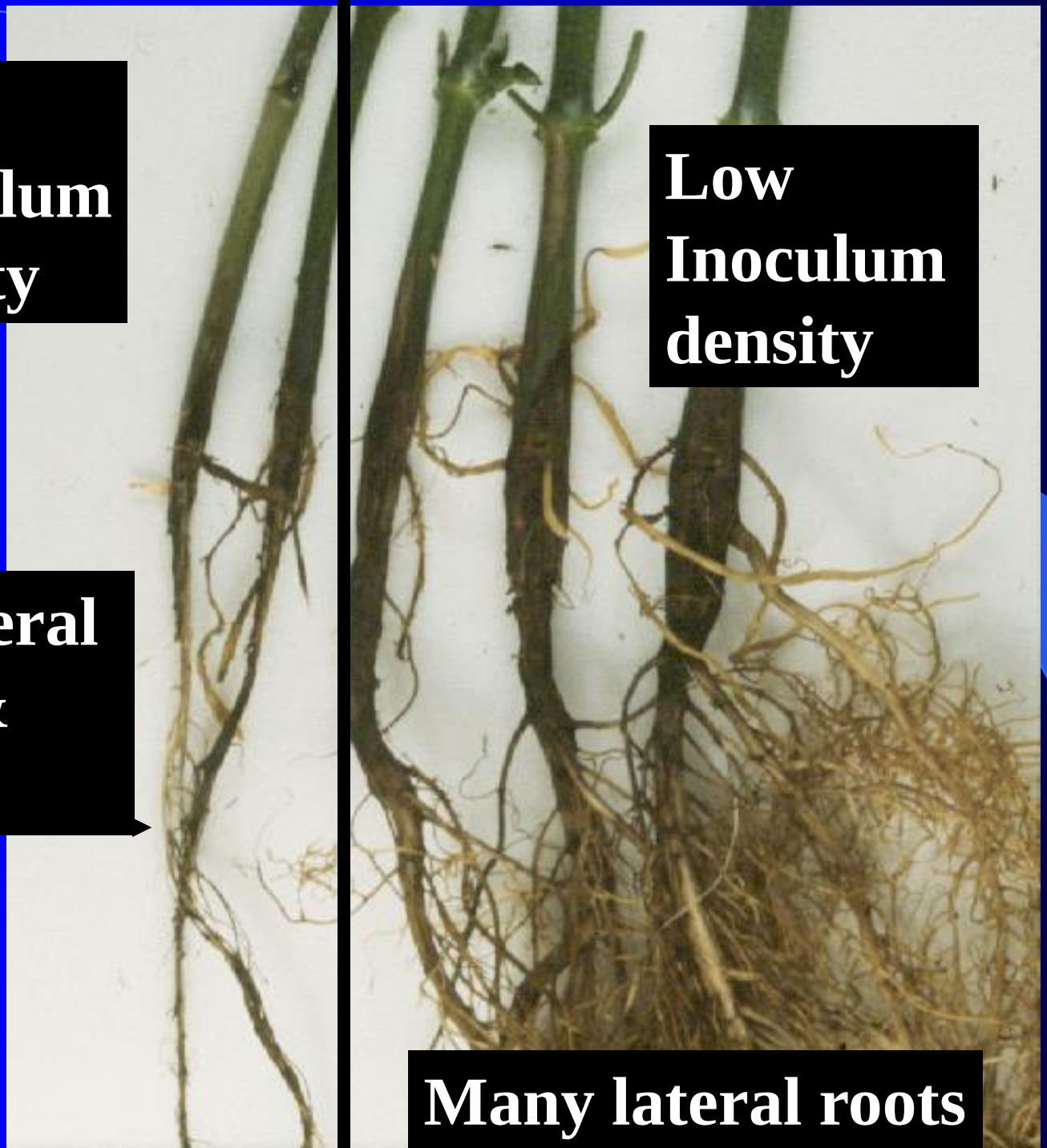
Close rotations can increase populations
Higher severity with high pathogen populations

Stressed plants show greater damage
Fungus also attacks dry bean

Fusarium root rot – notice patches of stunted plants

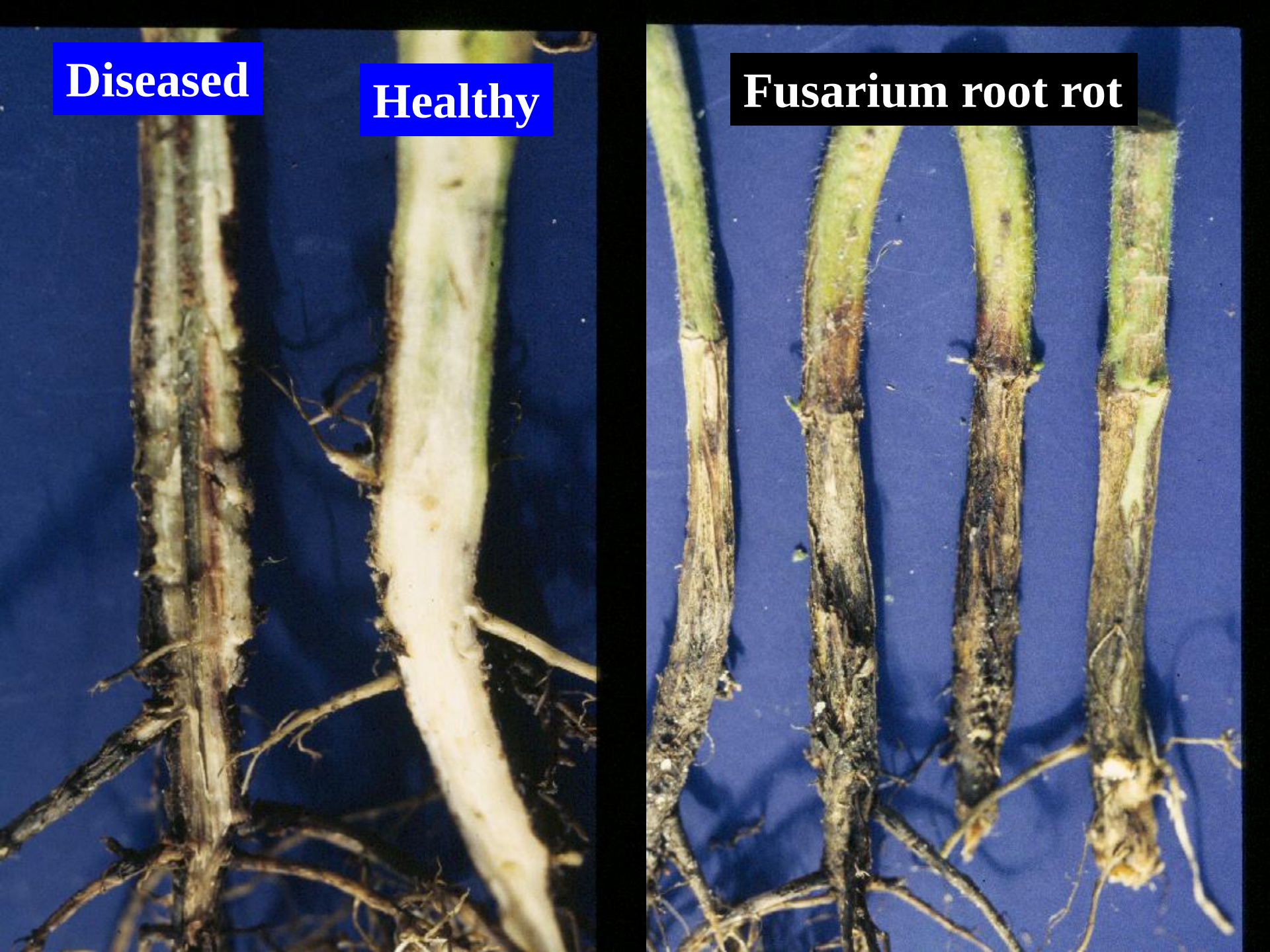
High Inoculum density

Few lateral Roots & cankers



Low Inoculum density

Many lateral roots


Diseased
Healthy
Fusarium root rot

Management of Fusarium root rot

No resistant cultivars identified.

Crop rotation will help reduce pathogen in soil

Seed treatment can help protect seedlings- Not adults

Cultural practices to reduce plant stress helpful

Soil conditions that reduce root growth favor disease.

Rhizoctonia damping off and root rot

***Rhizoctonia solani*: various AG groups**

- **AG 4, AG 5, AG2-2**

Commonly causes damping-off of seedlings (AG 4 & 5)

- **especially in poor conditions for seed germ**

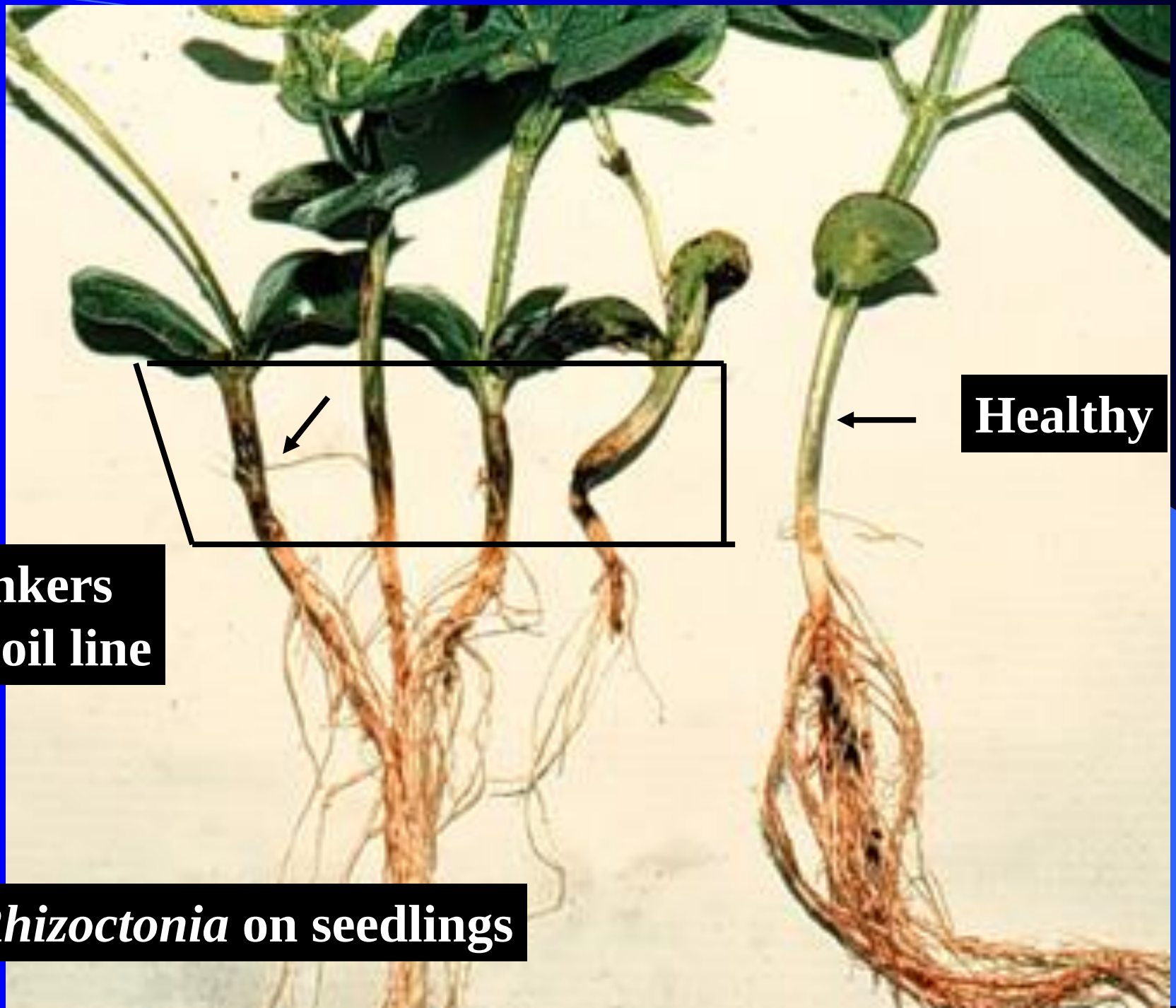
Can cause adult plant root rot

Close rotations can increase pathogen populations

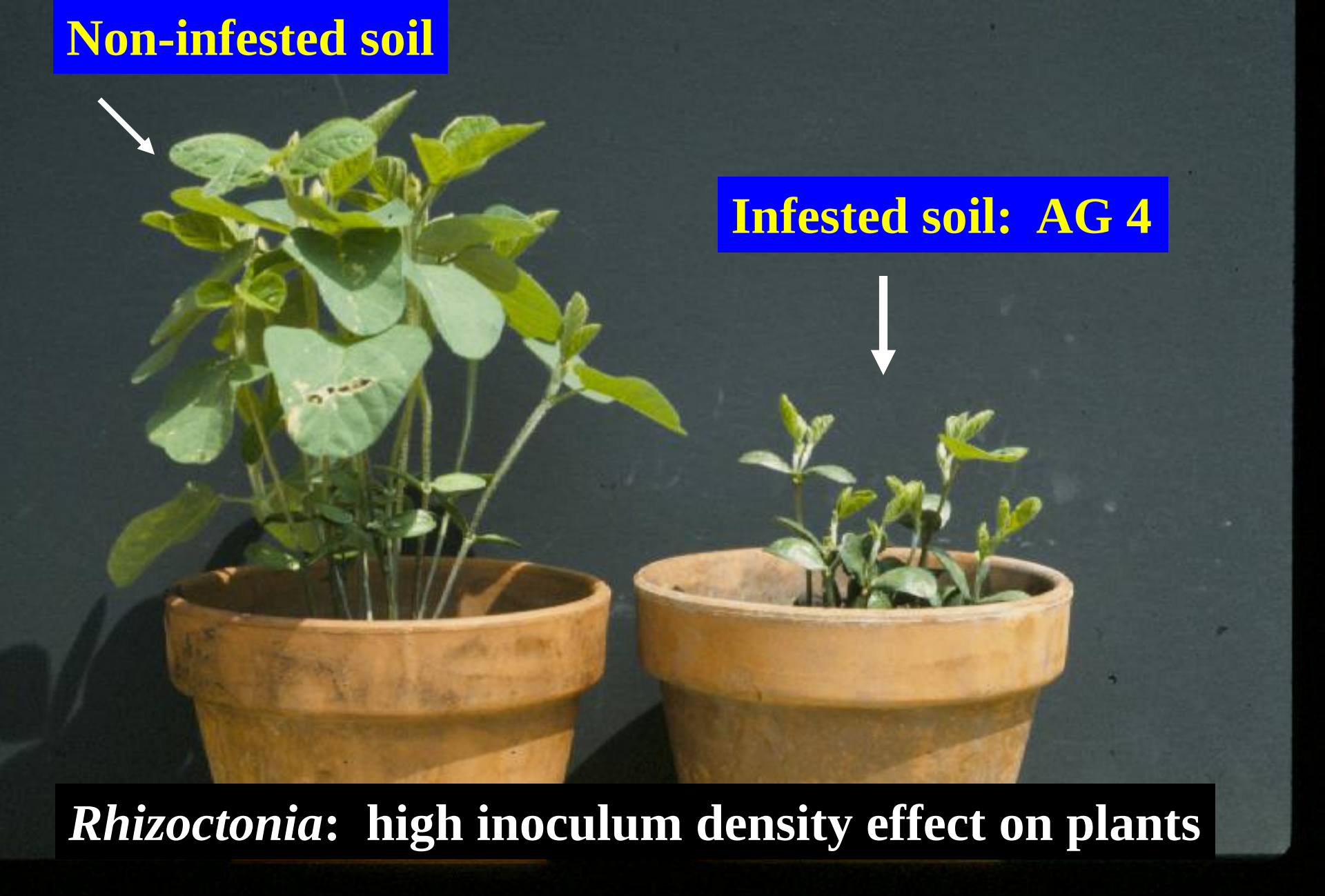
Stressed plants show greater damage

Fungus also attacks dry bean, sugar beets

Damping-off from *Rhizoctonia* AG 4



Rhizoctonia on seedlings



***Rhizoctonia*: high inoculum density effect on plants**

Might occur in fields with annual cropping to soybeans!!

Management of Rhizoctonia disease

Crop rotation will help reduce pathogen in soil

Avoid other susceptible crops- beets and dry beans

Seed treatments help seedlings - Not adult plants.
Cultural practices to reduce plant stress helpful.

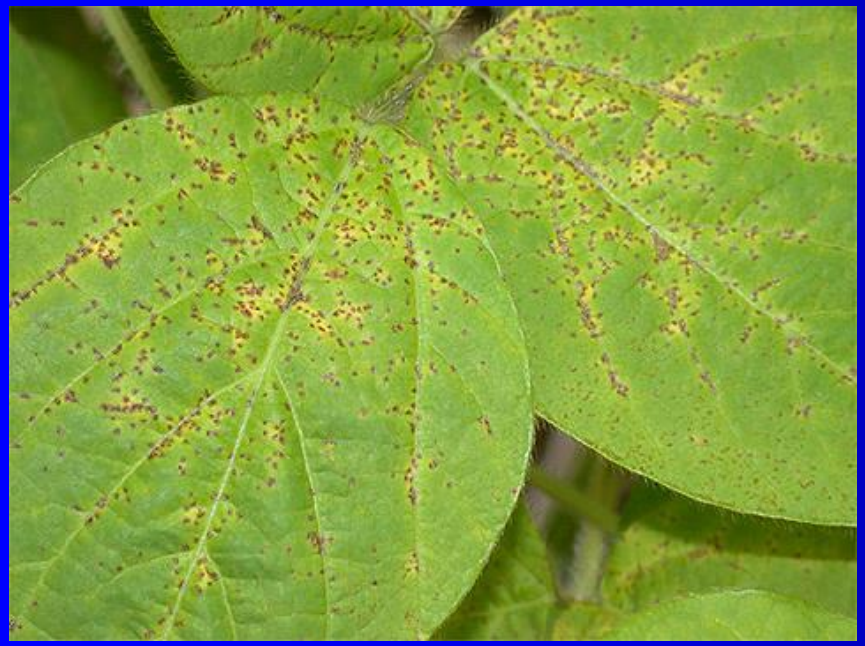
Good seedbed preparation reduces damage.

Soil conditions that reduce root growth favor disease

ASIAN SOYBEAN RUST

Phakopsora pachyrhizi

- Tan or reddish lesions on the leaf containing raised uredenia pustules on the underside of the leaf



Rust lesions on top-side of leaf.

Raised uredenia pustules on underside of leaf.

Found in US in 2004 in Louisiana, Mississippi, and Florida

http://www.oardc.ohio-state.edu/SoyRust/New_PDF/From_the_Editors.pdf

Sclerotinia stem rot (white mold)

Sclerotia in seed

Management of Sclerotinia stem rot

Canopy management -white mold increases as the row spacing is narrowed. Maintaining open rows so air movement through the crop reduces plant wetness can reduce disease.

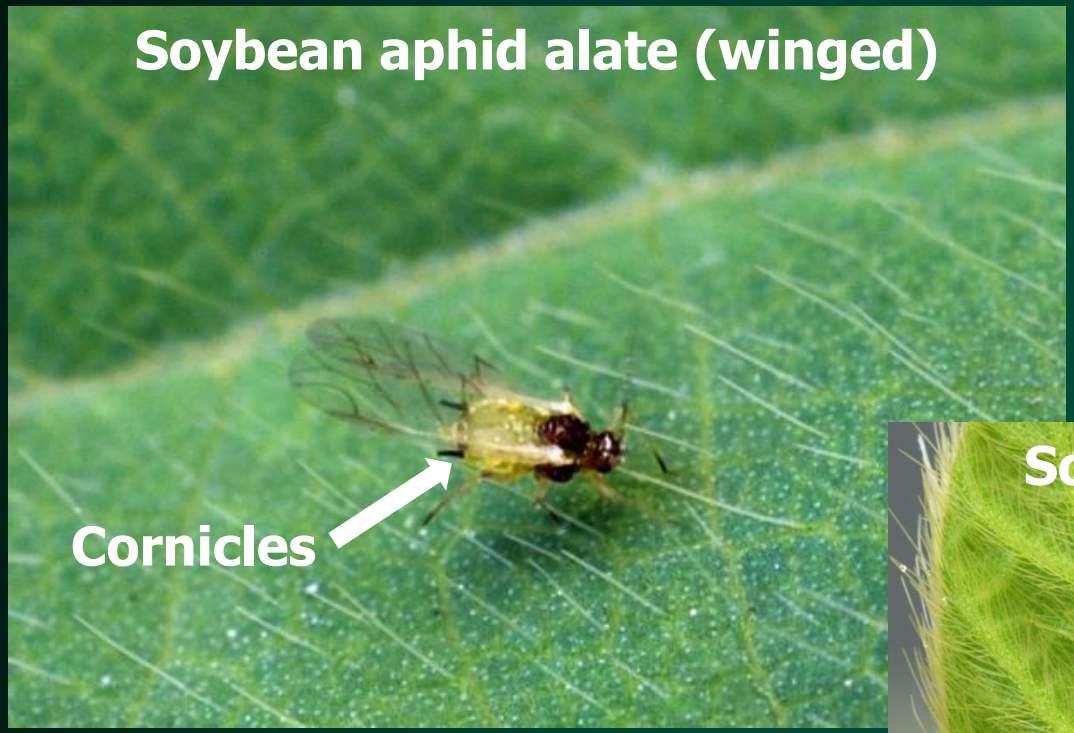
Lodging will favor disease development

Fungicides can be used for control.

Standard rotations: little affect on incidence of disease.

Tillage generally not useful in managing this disease.

Soybean aphid (*Aphis glycines*)



Prepared by Dr. Janet Knodel
Extension Entomologist
NDSU, Fargo, ND

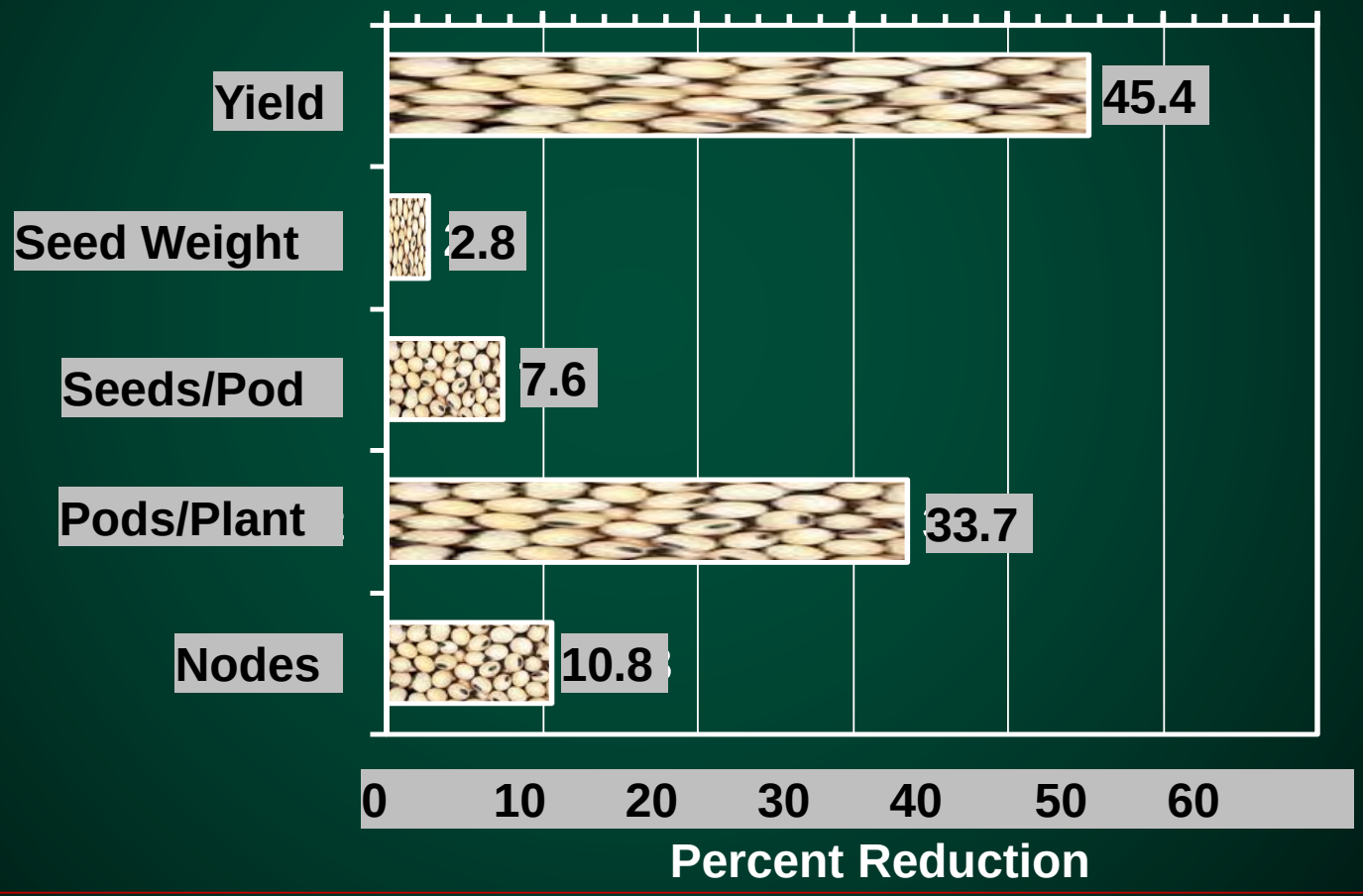
- Pale yellow
- Black cornicles (or tailpipes)
- About ⅛-inch long

NDSU EXTENSION SERVICE

Photographs by Patrick Beauzay

The Soybean Aphid's Impacts on Yield & Yield Components:

5 MN Fields in 2001



NDSU EXTENSION SERVICE

Source: K. Ostlie, University of Minnesota

Economic Threshold Soybean Aphid

- 250 aphids per plant
- 80% of plants in field infested
- Populations increasing

Threshold increases; inconsistent yield gain

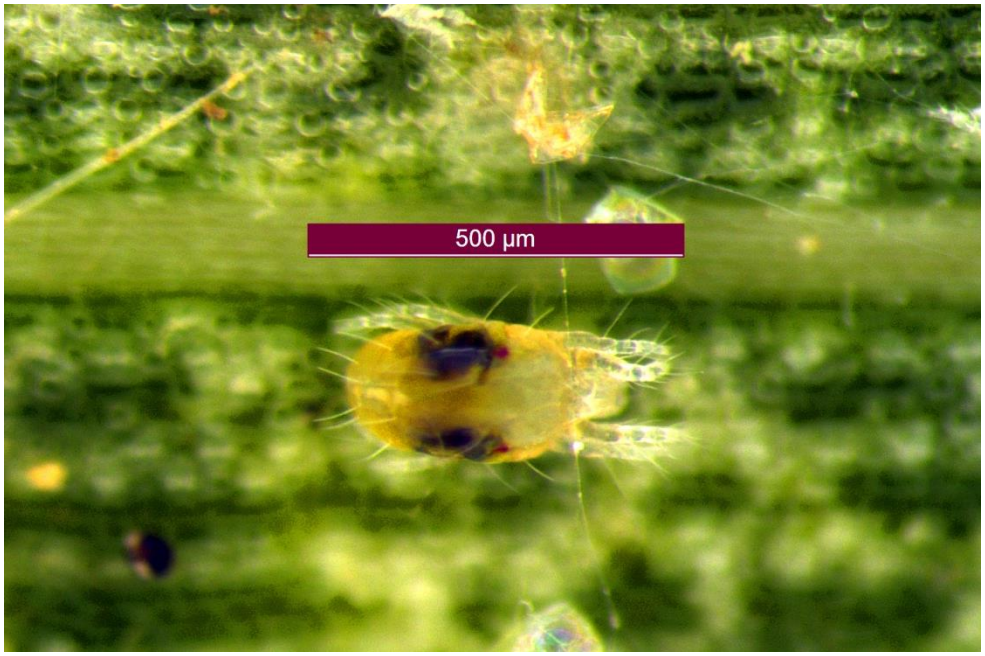
Do NOT treat

Veg. stages	R1 – R2 Bloom	R3-R4 Pods growing	R5 Start of seed set	R6 Full seed set	R7 Matur-ing	R8 Mature

NDSU EXTENSION SERVICE

Chris DiFonzo, Michigan State University

Two-spotted Spider Mite (*Tetranychus urticae*) in Soybeans



Tiny, yellow mites with two dark spots on sides of abdomen

Life Cycle of Two-Spotted Spider Mites

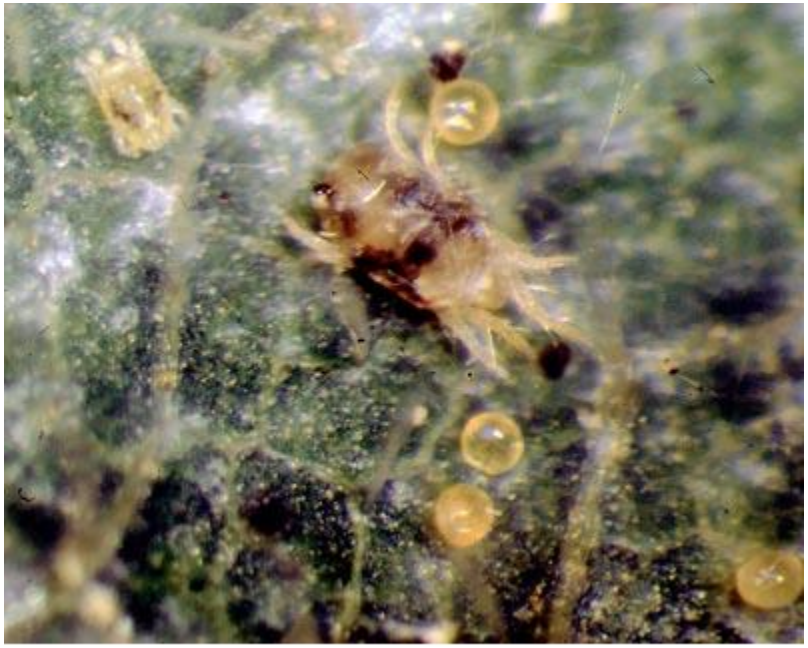
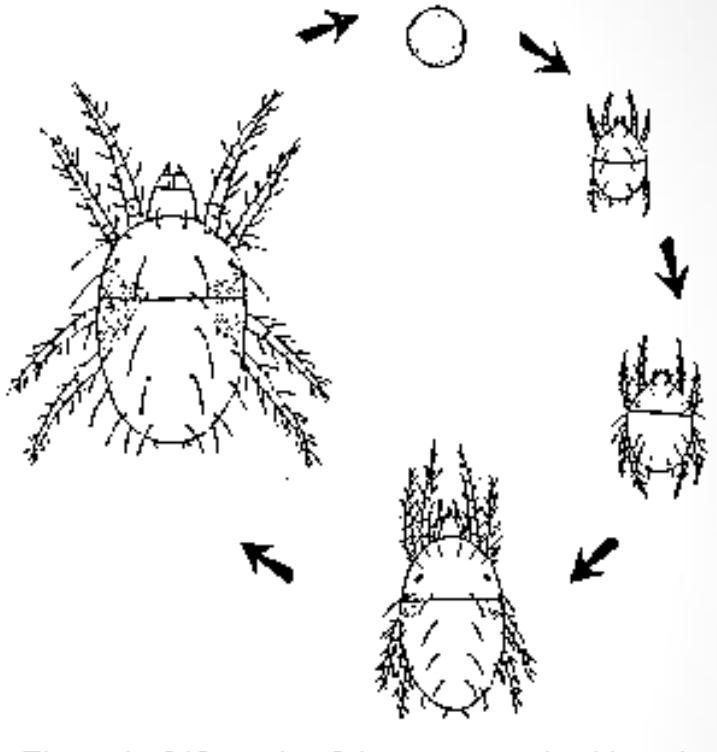


Photo credit Tom Klubertanz

- Attack a wide variety of crops, ornamentals and trees
- Overwinter as eggs in permanent vegetation
- Egg to adult development takes 5-19 days, faster at hotter temps
- Wind-blown dispersal via a silk thread



Life stages of the two-spotted spider mite:
Egg-larva-protonymph-deutonymph-adult

Assessing Spider Mite Injury - UMN

0 – No spider mites or injury observed.

1 – Minor stipling on lower leaves, no premature yellowing observed

2 – Stipling common on lower leaves, small areas or scattered plants with yellowing

3 – Heavy stipling on lower leaves with some stipling progressing into middle canopy. Mites present in middle canopy with scattered colonies in upper canopy. Lower leaf yellowing common. Small areas with lower leaf loss. ***(Spray Threshold)***

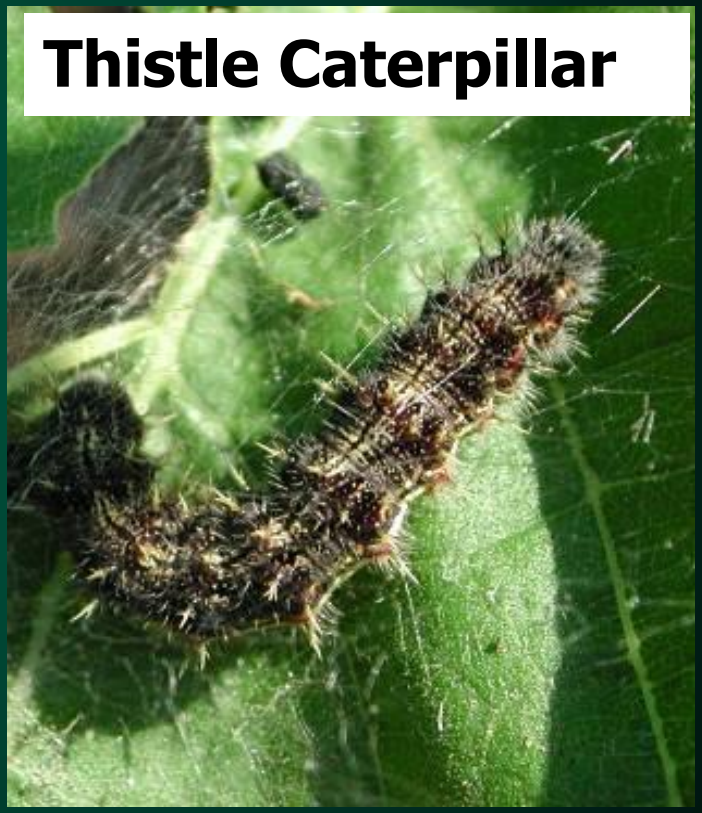
4 – Lower leaf yellowing readily apparent. Leaf drop common. Stipling, webbing and mites common in middle canopy. Mites and minor stipling present in upper canopy. ***(Economic Loss)***

5 – Lower leaf loss common, yellowing or browning moving up plant into middle canopy, stipling and distortion of upper leaves common. Mites present in high levels in middle and lower canopy.

Photos by Ken Ostlie

Foliage Feeding Caterpillars

- Caterpillars include:
  - Green cloverworm
  - Loopers
  - Velvetbean caterpillar
  - Thistle caterpillar
- Monitor for presence visually or use beat sheet
- Threshold is based on defoliation of foliage



Be concerned about sugar beet cyst nematode (SBCN) moving in to canola production areas.

Canola is a host and we do not know the effect of SBCN on canola